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Poultry Housing Tips

Proper Circulation Pump Sizing

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Evaporative cooling pad circulation pumps are much like fans, except they move water instead of air. Like fans, every model of pump has it own characteristics. We know from working with fans that there is more to selecting a fan than making sure it has the right size motor. Sure, a fan with a larger motor will tend to move more air than one with a smaller motor, but this is not always the case. Even fans with the same size motor do not always move the same amount of air. A 48" fan with a 1 h.p. motor can move anywhere from 18,000 to 25,000 cfm. Last but not least, all 48" fans with a 1 h.p. motor do not hold up to pressure the same. While the output of some fans will drop just a few percent as the pressure increases from 0.05" to 0.10", the air moving capacity of others will decrease well over ten percent. Because there are significant differences in air moving capacity between 48" fans with 1 h.p. motor , it is important that in order to maximize bird cooling that producers select a fan not by motor size, but rather by how much air the fan will move under typical operating pressures.

One of the best ways of studying the air moving capacity of a fan is to examine its performance curve (Figure 1). For instance, in a tunnel-ventilated house with evaporative cooling pads the fans will typically be working under a static pressure of approximately 0.10". Using a performance curve a producer can determine not only if the fan will move a sufficient amount of air at a static pressure of 0.10", but how the fan will perform if the pads and shutters become dirty and the pressure increases to 0.15".

Just as all 1 h.p. 48" fans do not move the same amount of air, all 1/2 hp submersible circulation pumps do not move the same amount of water. And just like when you are purchasing a fan for your house you need to know how much air it will move under pressure, when purchasing a pump for your circulation system you need to know how much water it moves under typical operating pressures.

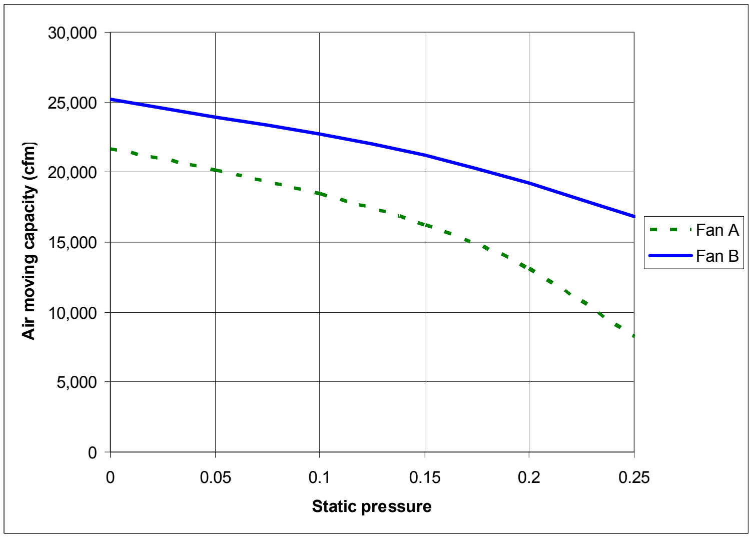

Figure 1. Air moving capacity Vs. Static pressure

How much pressure does a circulation pump work under?
With fans we measure pressure in terms of inches of water column; with pumps pressure is typically measured in feet of water column, more commonly referred to as feet of head pressure (2.31 feet of head pressure is equal to 1 psi). If a pump has to lift water up one foot, it is said to be working against one foot of head pressure. Other systems losses such as pipe friction and restrictions due to fittings and filters are expressed in terms of feet of pumping head. For the typical system, for the pump to move water from the bottom of the sump through the filter, elbows, valves, and down the length of the distribution system typically requires between 15 and 20 feet of head pressure.

How much water should a circulation pump move?
To insure that six-inch evaporative cooling pads remain uniformly wet on the hottest of days, as well as to keep dust and mineral build-up to a minimum, it is important that a pad system's circulation pump is capable of moving a minimum of 0.75 gallons per minute per linear foot of pad length (GPM/ft). A pump's ability to deliver the required amount of water is determined to a large extent by the amount of pressure the pump is forced to work against. Quite simply, as resistance to water flow in the piping increases, the amount of water circulated by the pump decreases. If there is excessive resistance, the pump will deliver less water to the point where dry spots and streaking occur, significantly reducing the amount of cooling produced by the pads.

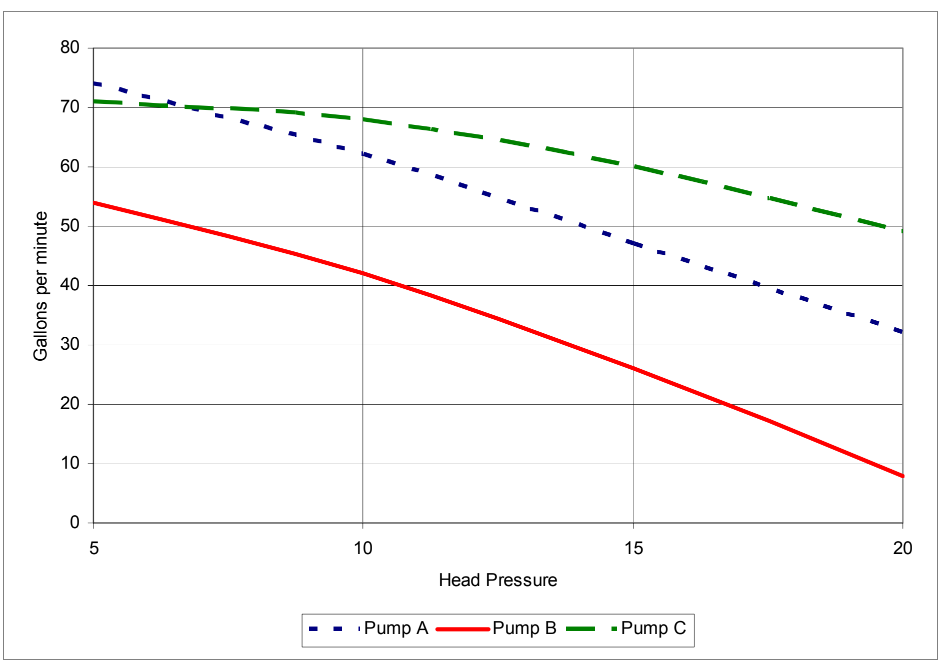

Figure 2. Water moving capacity Vs. Head pressure

Comparing circulation pumps
Figure 1illustrates the water moving capacity of three popular submersible pumps under different head pressures. Pump A has a 1/2 h.p. motor, while Pump B and C have 4/10 h.p. motors. Though all of the pumps are roughly 1/2 h.p. there is approximately a three fold difference in the amount of water they move at normal operating pressures of 15 to 20 feet of head. Furthermore, the "smaller" 4/10 h.p. pumps moves more water than the 1/2 h.p. pump while the other moves less water.

If we had a 50-foot pad system requiring 38 gals/min of circulation pump capacity and 15 feet of head pressure only Pump A and Pump C would move sufficient water while Pump B would move less than half the required water. If the system was 60 feet long (45 gals/min) only Pump C would circulate the proper amount of water.

The problem is that circulation pumps like Pump B are being installed in many systems today. Whereas a pump like this did an adequate job in the past when many systems were only 40 feet long, with today's 50-foot plus systems they simply do not pump enough water to insure sufficient water flow over and through the pad to insure maximum cooling as well as keeping the pad free of dust and minerals. Bottom line, pad systems have gotten longer and in many cases we are using the same pumps as before.

Another reason for improper circulation pump sizing is that many people are not sizing their pumps at the proper pressure. The reasoning is since the pump is only moving the water up five or six feet (bottom of the sump to the distribution pipe), it is only working against six feet of head pressure. Under this logic all the above pumps would work for systems as long as 80 feet and in fact, Pump A and C could be viewed as moving too much water. But, as mentioned previously, moving water to through valves, elbows, and filters increases the six feet of head pressure to between 15 and 20 feet.

The trick with an improperly sized circulation pump is that it may not cause problems for years. During humid weather it does not take a lot of circulation pump capacity to keep the pads wet. But, when it gets 90 to 100ºF and the humidity falls, water evaporation goes up dramatically and if the pump is not circulating enough water the pads begin to streak and cooling will be reduced. Furthermore, the build up of dust and minerals on pads occurs slowly over time. And as a result the difference between a pad with sufficient water flow and one without may not be noticeable for years. By the time the difference is notable, the damage is done and pad life has been significantly reduced.

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